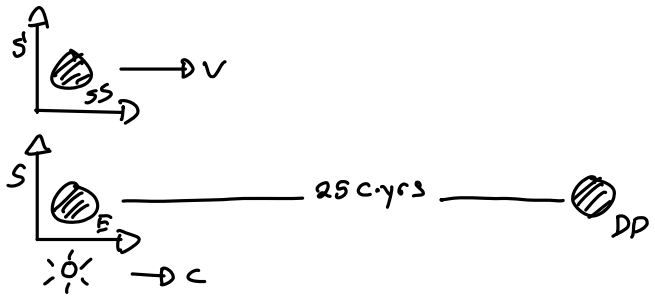
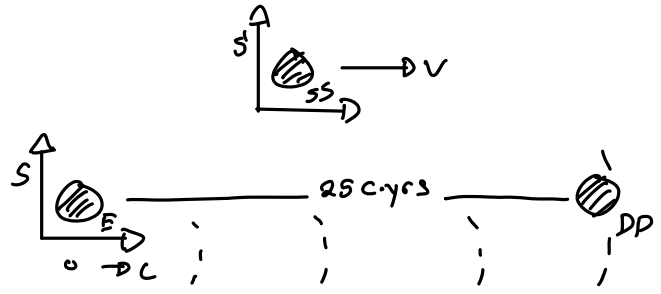
Taylor Larrechea
Dr. Middleton
PHYS 230 HW 9

Problem 1

a.) $E_1$




$E_2$




$D = 25$ c·yrs $\quad \Delta t = \frac{D}{V}$

$V = C$

$$\Delta t = \frac{D}{V} = \frac{25 \text{ c·yrs}}{C} = 25 \text{ yrs}$$

$\Delta t_{DP} = 25$ yrs

b.) $x = 25$ c·yrs
$t = 25$ yrs
$v = (5/13)C$
$\gamma = (13/12)$

$$x' = \gamma(x - vt) = \left(\frac{13}{12}\right)\left[25 \text{ c·yrs} - \left(\frac{5}{13}\right)C\left(25\right) \text{yrs}\right)$$

$x' = \frac{50}{3}$ c·yrs

c.) $t = 25$ yrs
$x = 25$ c·yrs
$\gamma = (13/12)$
$V = (5/13)C$

$$t' = \gamma(x - vt) = (13/12)(25 \text{ c·yrs} - (5/13)(C)(25) \text{yrs})$$

$t' = \frac{50}{3}$ yrs

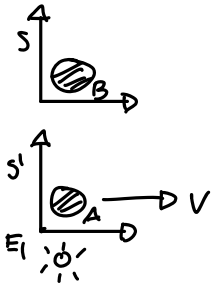
ratio of $\frac{x}{t}$ must equal $C$

# Problem 2

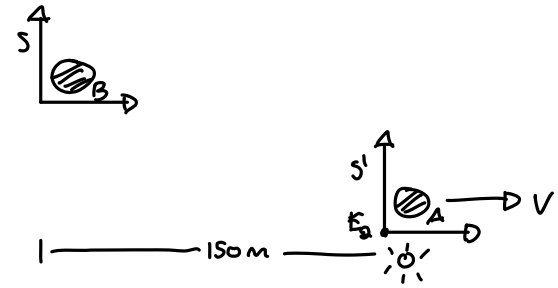
a.)

$v=(4/5)c$

$E_1$




$E_2$




$v=(4/5)c$ $\quad D'=150\,m$ $\quad v=c$

$\gamma=(5/3)$ $\quad \Delta t' = \frac{D'}{v} = \frac{150\,m}{c} = 150\,m/c$ $\quad \Delta t' = 150\,m/c$

$t=\gamma(t'+vx'/c^2)$

$t'=150\,m/c$

$x'=150\,m/c$

$v=(4/5)c$

$\Delta t' = 150\,m/c$

b.) $x=\gamma(x'+vt')$ $\quad x=(5/3)(150\,m+(4/5)c(150)m/c)$

$\gamma=(5/3)$ $\quad x=450\,m$

$x'=150\,m$

$t'=150\,m/c$

$v=(4/5)c$

$x=450\,m$

c.) $t=\gamma(t'+vx'/c^2)$ $\quad t=(5/3)(150\,m/c+\frac{(4/5)c(150)m}{c^2})$

$t'=150\,m/c$ $\quad t=450\,m/c$

$x'=150\,m$

$\gamma=(5/3)$

$v=(4/5)c$

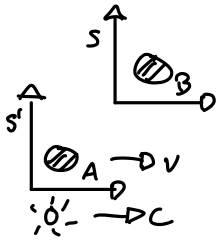
$t=450\,m/c$

# Problem 3

a.)

$D_B = 450\,m$

$D_A = 90\,m$




$T_B$ : $V = C$ $\quad \Delta t = \frac{D}{V}$

$D = 450\,m$

$\Delta t = \frac{450\,m}{c} = 450\,m/c$

$\Delta x = 450\,m$

$\Delta t = 450\,m/c$

b.) $x' = \gamma(x - Vt)$

$\gamma = (3/3)$

$t = 450\,m/c$

$x = 450\,m$

$V = (4/5)c$

$x' = (3/3)(450m - (4/5)c(450)m/c)$

$x' = (3/3)(90\,m)$

$x' = 150\,m$

$\Delta x' = 150\,m$

c.) $t' = \gamma(t - Vx/c^2)$

$t = 450\,m/c$

$x = 450\,m$

$V = (4/5)c$

$\gamma = (3/3)$

$t' = (3/3)\left(450\,m/c - \frac{(4/5)c(450)m}{c^2}\right)$

$t' = (3/3)(90\,m/c)$

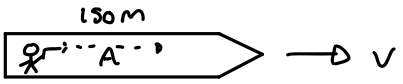
$t' = 150\,m/c$

$\Delta t' = 150\,m/c$

# Problem 4

$V = (4/5)c$

$V_x' = (3/5)c$




a.) $V_x = \dfrac{V_x' + V}{1 + V \cdot V_x'/c^2}$ $\qquad V_x = \dfrac{(3/5)c + (4/5)c}{1 + \dfrac{(3/5)c(4/5)c}{c^2}} = \dfrac{(7/5)c}{(37/25)} = \dfrac{(35/25)c}{(37/25)} = \left(\dfrac{35}{37}\right)c$

$V_x' = (3/5)c$

$V = (4/5)c$

$V_x = \left(\dfrac{35}{37}\right)c$

b.)

(i) $d = D \cdot \sqrt{1 - (V/c)^2}$ $\qquad d = 150m\,(3/5) = 90m$

$D = 150m$

$d = 90m$

(ii) $d = 150m$

(iii) $V = (3/5)c \quad \therefore \quad d = 150m\,(4/5) = 120m$

$d = 120m$

c.)

(i) $D = 150m$ $\qquad \Delta t = \dfrac{D}{V}$ $\qquad \Delta t = \dfrac{150m}{(3/5)c} = 250\,m/c$

$V = (3/5)c$

$\Delta t' = 250\,m/c$

(ii) $t = \gamma(t' + Vx'/c^2)$

$x' = 150m$

$t' = 250\,m/c$

$\gamma = (3/3)$

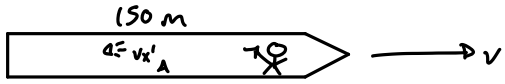
$V = (4/5)c$

$\Delta t = \dfrac{1850}{3}\,m/c$

# Problem 5

$V = (4/5)c$

$V_x = -(3/5)c$




a.) $v_x' = \dfrac{v_x - v}{1 - vv_x/c^2} = \dfrac{-(3/5)c - (4/5)c}{1 - \frac{(4/5)c(-3/5)c}{c^2}} = \dfrac{-(7/5)c}{(37/25)} = \dfrac{-(35/25)c}{(37/25)}$

$$v_x' = \left(\frac{-35}{37}\right)c$$

b.) $v = (35/37)c$

$D = (150)m$

$d = D\sqrt{1-(v/c)^2}$

$d = 150m\sqrt{1-(35/37)^2} = \dfrac{1800}{37}m$

$$d = \frac{1800}{37}m$$

c.) (i) $D = 150m$

$v = (35/37)c$

$\Delta t = \dfrac{D}{v} = \dfrac{150\,m}{(35/37)c} = \dfrac{1110}{7}\,m/c$

$$\Delta t' = \frac{1110}{7}\,m/c$$

(ii) $t = \gamma(t' + vx'/c^2)$

$t' = \dfrac{1110}{7}\,m/c$

$x' = -150\,m$

$v = (4/5)c$

$\gamma = (5/3)$

$t = (5/3)\left(\frac{1110}{7}\,m/c + \frac{(4/5)c(-150m)}{c^2}\right)$

$t = (5/3)\left(\frac{270}{7}\,m/c\right)$

$t = \dfrac{450}{7}\,m/c$

$$\Delta t = \frac{450}{7}\,m/c$$